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Service Life of Telephone Poles on the Island of Hawaii[1]

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ABSTRACT: Records on service life of telephone poles showed that after 20 years, untreated redwood poles averaged 94 percent still serviceable, pressure-treated Douglas-fir 84 percent serviceable, and pressure-treated southern pine 74 percent serviceable. Seventy-five percent of the untreated western redcedar remained serviceable after 20 years. Non-pressure treated ohia and eucalyptus had a much shorter service life.

How long do telephone and utility poles last in Hawaii? Most public utility companies have kept records of the service life of their poles. The Hawaiian Telephone Company has such records dating back to the early 1920's. They provided an opportunity to gather data on the service life of the species more commonly used for poles and also of some locally grown woods being tested. The records are from the Island of Hawaii only, but findings should apply to other areas with similar conditions.

PROCEDURE

Service life data for this study were collected from two sources: the Hilo office of Hawaiian Telephone Company, and the Kulani Honor Camp of the Hawaii Department of Social Services. The Kulani records gave rather limited information on a telephone line that uses ohia (Metrosideros collina) poles.

Records of the telephone company include information on such species as Douglas-fir (Pseudotsuga menziesii), southern pine (Pinus spp.), redwood (Sequoia sempervirens), western redcedar (Thuja plicata), and mixed species of eucalyptus (Eucalyptus spp.). They date from 1922 and cover varying conditions of exposure and treatments throughout the island.

Nine representative sample areas in the island were selected from those having poles replaced after failing under normal

[1]The help of E. K. Yamamoto and his staff at the Hilo office, Hawaiian Telephone Company, in making data available for this study is gratefully acknowledged.

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conditions. No areas were selected where lines had been relocated or where poles were replaced because taller or larger poles were required. The specific reasons for replacing a given pole, e.g., hit by vehicle, lightning, wind damage, termites, decay, etc., are not recorded. Areas were chosen to represent a range of rainfall, elevations, and urban and rural locations.

TREATMENTS AND RETENTIONS

The Douglas-fir and southern pine poles were pressure-treated with creosote--presumably to American Wood-Preservers' Association specifications of 8 lbs. per cu. ft. retention. The western redcedar and redwood were untreated. Because an undetermined number of the redwood poles were sawn square, they were probably all heartwood. The western redcedar poles were all round. Treatment of the ohia poles consisted of brush coating the butts and top 3 to 4 ft. with "Ebonal," a black undercoating compound. The eucalyptus poles were treated by dipping the butts in a hot creosote bath for several hours.

POLES IN URBAN AREAS

Data for urban areas were separated from those for rural areas primarily for two reasons: (a) Termites are thought to be found only in urban areas,[2] and (b) more poles are replaced in urban areas because of mechanical damage, i.e., struck by vehicles, than in rural areas. The primary reason for replacement in rural areas is considered to be decay at or near the ground line. In urban areas, this decay is coupled with termites and mechanical damage.

Three species--redwood, southern pine, and Douglas-fir--are represented in the urban area (fig. 1), where rainfall ranges from 130 to 200 inches annually. Redwood showed no failures after 20 years' service, but dropped sharply to 60 percent serviceable after 25 years and to zero percent serviceable after 32 years. Douglas-fir and southern pine declined at about the same rate. After 20 years Douglas-fir averaged 75 percent of the poles remaining serviceable and southern pine averaged 73 percent remaining serviceable. And after 25 years, Douglas-fir averaged 58 percent serviceable and southern pine 54 percent.

PRESSURE-TREATED POLES IN RURAL AREAS

Two pressure-treated species, Douglas-fir and southern pine, are represented in the rural areas (fig. 2). The three Douglas-fir lines were fairly consistent; 89 percent of the poles remain serviceable after 20 years. The two southern pine lines sampled were not conclusive. One sample of 161 poles showed 91 percent serviceable after 15 years and 90 percent after 20 years. The other sample of 56 poles in a similar rainfall area, showed only 68 percent serviceable after 15 years, 59 percent after 20 years and 39 percent after 25 years' service.

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[2]Personal communication with personnel of Hawaiian Telephone Co., and of Hawaiian Electric Co.

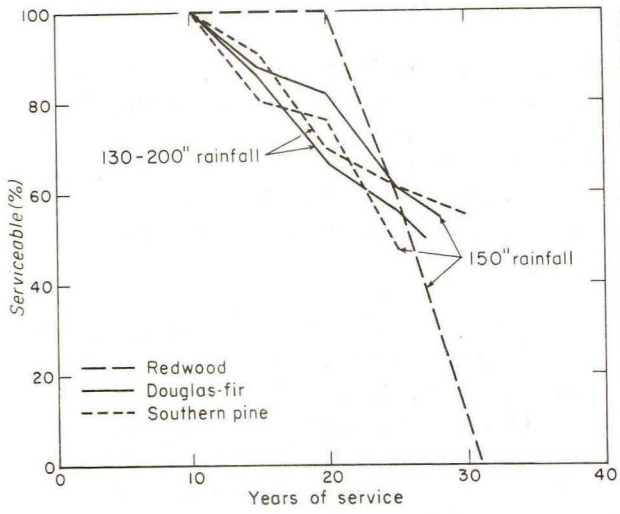

Figure 1.--Service life of poles in an urban area (Hilo), under rainfall conditions shown.

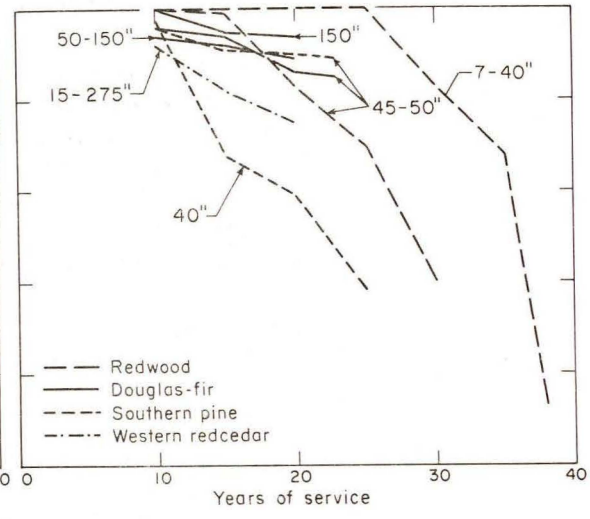

Figure 2.--Service life of poles in rural areas, under rainfall conditions shown.

Neither rainfall nor elevational differences appeared to have had any effect on the two treated species.

UNTREATED REDWOOD AND WESTERN REDCEDAR IN RURAL AREAS

Two redwood lines and one western redcedar line are represented in the rural areas (fig. 2). Data for the redwood poles suggested that such poles had longer life in the drier areas. The Kawaihae line, in an area where rainfall ranges from 7 to 40 inches annually, showed no failures after 25 years' service, 83 percent serviceable after 30 years, 68 percent serviceable after 35 years, and 13 percent serviceable after 39 years. On the other line, in an area with an annual rainfall of 45 to 50 inches, 83 percent of the poles were serviceable after 20 years, 70 percent serviceable after 25 years and 40 percent serviceable after 30 years. However, telephone company personnel recall that when more redwood poles were in service than now, there was a problem of Carpenter Bee attack in the dry areas. They believed that redwood lasted longer if used in wetter areas because of fewer Carpenter Bee attacks.

The line using western redcedar poles was built in 1943. It used 1,175 poles and extended from near Hilo along the Saddle Road, through the Military Training Area at Pohakuloa to Waikii. This route covers a range in elevation from 1,550 ft. to 6,600 ft. and in rainfall from 15 to 275 inches. After 10 years, 92 percent of the poles in this line were serviceable; after 15 years, 82 percent serviceable; and after 20 years, 75 percent serviceable. Nearly all replacements were in the wetter areas, i.e., in excess of 50 inches of rainfall per year. Failures were caused almost entirely by decay at or below the ground line.

LOCALLY GROWN POLES IN RURAL AREAS

At least two trials of locally grown poles have been made. One line using the brush-coated ohia poles extends from near Hilo to the Kulani Honor Camp. The other was a trial of 65 poles of mixed eucalyptus species installed in 1931 in an area having a rainfall of about 150 inches annually. The butts of the eucalyptus were dipped in hot creosote for several hours. Replacement started in 1937 after only 6 years' service. The poles were completely replaced by 1939.

The ohia pole line begins at an elevation of 150 ft., where annual rainfall is 137 inches, goes through an area of 225 inch rainfall, and ends at 5, 190 ft. elevation, where rainfall is 98 inches. About 740 poles were cut from a native forest in the fall of 1955, and left there to season. In February 1958, these poles were brush coated with "Ebonal" on the butts and top 3 or 4 ft. A total of 710 poles were installed during the spring and summer of 1958. The first pole was replaced after 3 years' service. By 1963--when maintenance was taken over by the Hawaiian Telephone Company--150 poles had been replaced. Thus, after 5 years' service 79 percent remained serviceable. Almost all replacements were in the high rainfall area and were a result of decay, primarily at the ground line, or rotten tops, which allowed the insulators to fall from the pole. The telephone company is gradually replacing the poles with pressure-treated Douglas-fir. The poles carry only two insulators, and as long as the service is uninterrupted, the ohia poles are not replaced--although many are in poor condition. Replacements by the Honor Camp consisted of untreated ohia poles averaging 6 inches at the ground line.

SUMMARY

Of the several species and treatments observed in this study, untreated redwood poles had the highest percentage of poles serviceable after 20 years (table 1). In rural and urban areas combined, redwood poles averaged 94 percent still serviceable.

The high percentage for redwood poles may be the result of an undetermined number of sawn "timbers" that presumably were all heartwood. Once redwood poles did start to fail, however, they failed quite rapidly (fig. 4). Their rate of failure was much higher than that for Douglas-fir and southern pine (figs. 3, 5).

All species generally had a longer life in rural than in urban areas. This longevity is attributed to the presence of termites only in the urban areas, to a higher incidence of reporting of damaged poles, and to increased mechanical damage to the poles in urban areas. The primary reason for replacing poles in the rural areas is decay at or near the ground line; occasionally poles are replaced because of mechanical or wind damage.

Higher rainfall affects untreated species more than it does pressure-treated species. The untreated redwood, western redcedar, and brush coated ohia all showed less failure in the lower rainfall areas. Any effect

Table 1.--*Service life of telephone poles in Hawaii, by species, 1965*

Telephone line and species	Rainfall (inches)	Elevation (feet)	Poles installed		Treatment	Percent remaining after years indicated--										
			Year	Number		10	15	20	23	25	27	28	30	32	35	39
Kohala:																
Southern pine	40	200-2,650	1938-40	56	Pressure creosote[1]	98	68	59	--	39	--	--	--	--	--	--
Kilauea Ave.:																
Douglas-fir	150	17-150	[2]1933-40	66	Pressure creosote	100	88	82	--	61	--	55	--	--	--	--
Redwood	150	17-150	1928	35	None	100	100	100	--	60	--	--	--	0	--	--
Southern pine	150	17-150	[2]1933-40	21	Pressure creosote	100	81	76	--	48	--	--	--	--	--	--
Wainuenue Ave.:																
Douglas-fir	130-200	17-600	1935	36	Pressure creosote	100	86	67	--	56	50	--	--	--	--	--
Southern pine	130-200	17-600	1935	33	Pressure creosote	100	91	70	--	61	--	--	55	--	--	--
Kawaihae Line:																
Redwood	7-40	50-2,650	1922	110	None	100	100	100	--	100	--	--	83	--	68	13
Saddle Road Line:																
Western redcedar	15-275	1,550-6,600	1943	1,175	None	92	82	75	--	--	--	--	--	--	--	--
Pahoa Line:																
Douglas-fir	150	280-670	1943	65	Pressure creosote	100	95	94	--	--	--	--	--	--	--	--
Olaa-Volcano Line:																
Douglas-fir	50-150	280-4,000	1944	133	Pressure creosote	94	92	89	--	--	--	--	--	--	--	--
Volcano Pahala Naalehu Line:																
Redwood	45-50	550-4,000	1931	405	None	100	99	83	--	70	--	--	40	--	--	--
Douglas-fir	45-50	550-4,000	1941	[3]241	Pressure creosote	96	94	87	86	--	--	--	--	--	--	--
Southern pine	45-50	550-4,000	1941	[3]161	Pressure creosote	96	91	90	89	--	--	--	--	--	--	--

Source: Hawaiian Telephone Company, Hilo, Hawaii.

[1]Assumed to be minimum retention of 8 lbs./cu. ft. AWPA Standard C4-63 (and earlier issues).

[2]Service life calculated from the year 1936.

[3]Of 402 poles, 60 percent (241) were estimated to be Douglas-fir, and 40 percent (161) to be southern pine.

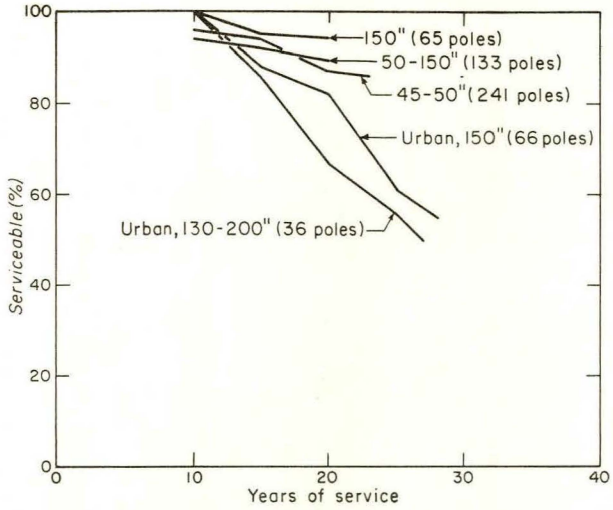

Figure 3.--Service life of Douglas-fir poles, under rainfall conditions shown.

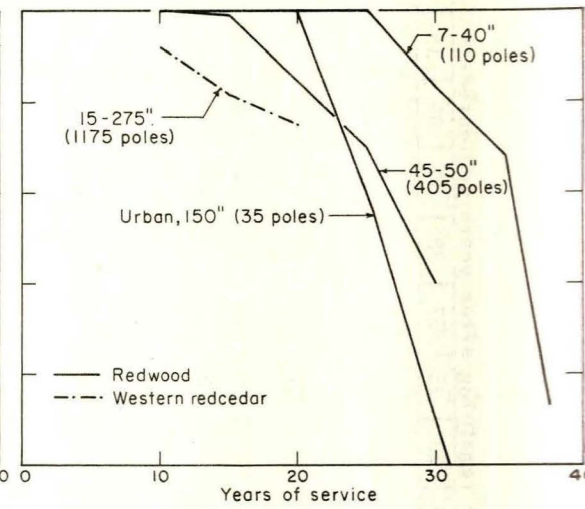

Figure 4.--Service life of redwood and western redcedar poles, under rainfall conditions shown.

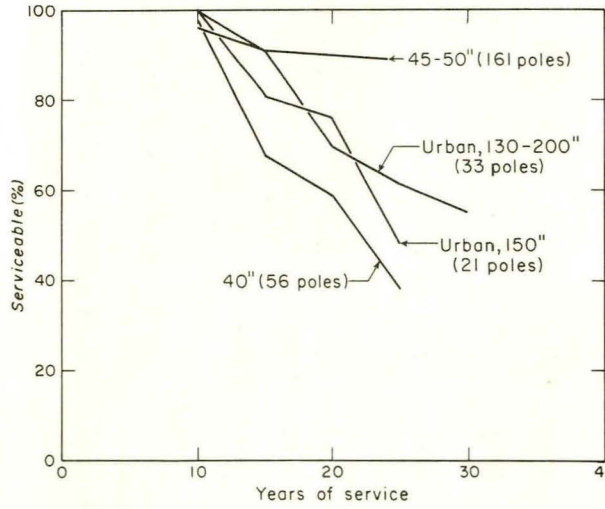

Figure 5.--Service life of southern pine poles, under rainfall conditions shown.

of differences in rainfall on the pressure-treated Douglas-fir or southern pine was not noticeable.

Of the other species studied, non-pressure-treated ohia and mixed eucalyptus did not perform satisfactorily. Seventy-five percent of the untreated western redcedar poles remained serviceable after 20 years.

The Author

R. SIDNEY BOONE joined the Station's research staff in Hawaii in 1964. Headquartered in Honolulu, he is studying the uses, properties, and processing of forest products. A 1959 forestry graduate of Louisiana State University, he earned a master's degree in wood utilization at Duke University (1960).